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ABSTRACT

The 1977-78 annual Graduate Student Survey analyzes information supplied by graduate physics students and also includes graduate astronomy students. Highlights of the findings are: a continuing decline in the number of graduate physics degree recipients; the reassurance of a steadily improving job market for new physicists with graduate degrees; a five percentage-point decrease in the proportion of graduates who accepted postdoctorates with a corresponding increase in employment offers with potential permanence; and a decline in astronomy enrollments and graduate degree recipients. Data are presented on the following areas: employment offers for new physics doctorate and masters recipients, 1973-78; characteristics of the graduate physics student population, 1977-78; characteristics of minority-group graduate physics students; graduate physics students by subfield and years of graduate study completed, 1977-78; sources of support by sex and degree status; number of advanced graduate physics students specializing in selected experimental or theoretical subfields by years of graduate study completed; type of research performed by doctoral candidates with respect to years of graduate study completed; employment offers for 1977-78 doctorate recipients by subfield and type of research; type of employer and work activity of physics terminal masters; and characteristics of astronomy graduate students and doctorate recipients. (SW)

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report

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1977-78 GRADUATE STUDENT SURVEY

by Susanne D. Ellis

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The annual Graduate Student Survey, conducted since the early 1960's, analyzes information supplied by graduate physics students. It was expanded to include graduate astronomy students four years ago. Highlights of this report are:

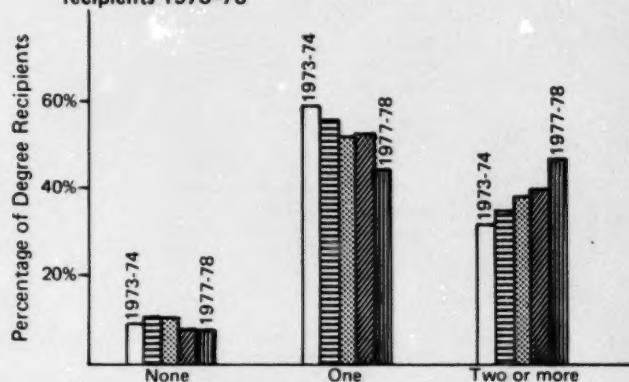
- a continuing decline in the number of graduate physics degree recipients
- the reassurance of a steadily improving job market for new physicists with graduate degrees
- a five percentage-point decrease in the proportion of graduates who accepted 'postdocs' with a corresponding increase in employment offers with potential permanence
- a decline in astronomy enrollments and graduate degree recipients

The graduate student population in the physics doctorate granting departments is starting to level off in 1977-78 after declining for almost a decade. The improving employment opportunities for physicists may well be responsible for this change in trend. A look at **Figures I and II** outlines the changing opportunities for the most recent five-year period.

To be more specific, **Figure I** shows a steady 8%-10% "zero job offers" for new doctorate recipients immediately after graduation; for that same period a decrease in single job offers corresponded to an increase in multiple offers. However, **Figures I and II** present only the quantitative employment picture; other portions of this report address themselves to the relevance and quality of these employment offers.

Figure II focuses on new physicists who terminate their graduate studies with the master's degree and seek immediate employment. As **Figure III** shows, the response rate from this group is not very high, nevertheless the histogram of **Figure II** indicates relative stability in employment opportunities for those who responded.

Fig. I. Employment offers for new physics doctorate recipients 1973-78



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Fig. II. Employment offers for new physics masters 1973-78

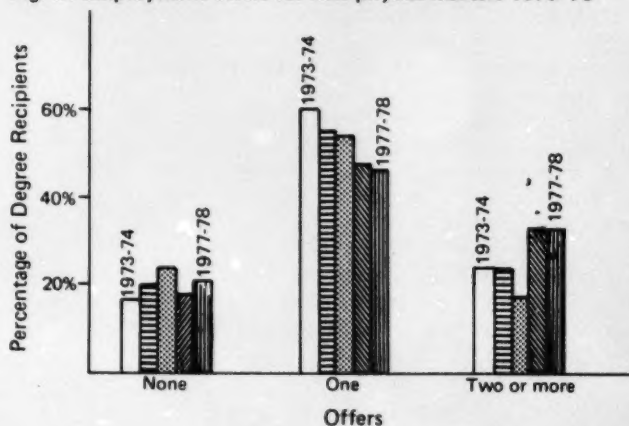


Table I. Characteristics of the graduate physics student population, 1977-78

Characteristics		All graduate students 9835 Number of respondents: 5357	First-year graduate students 2499 1095	Degree recipients:	
				Terminal masters 695 268	Doctorate recipients 971 505
Sex	Female	9%	10%	11%	7%
	Male	91	90	89	93
Citizenship	U.S.	79%	83%	89%	77%
	Foreign	21	17	11	23
Type of high school physics	PSSC**	33%	30%	28%	36%
	Project physics	5	10	8	3
	Other	54	48	56	53
	None	8	12	8	8
Type of bachelor's institution	PhD-granting	53%	53%	44%	52%
	MS-granting	10	12	20	8
	BS/BA-granting	19	21	25	18
	Foreign	18	14	11	22
Type of graduate institution	PhD-granting	93%	86%	74%	100%
	MS-granting	7	14	26	-
Student status	Full-time	89%	86%	74%	92%
	Part-time	11	14	26	8
Source of support	Teaching assistantship	37%	58%	41%	17%
	Research assistantship	39	13	18	54
	Fellowship	10	12	4	9
	Employment	8	9	26	13
	Family, savings, loan	3	5	3	2
	Other	3	3	8	5

* These totals were reported by physics department chairmen as part of the Survey of Enrollments and Degrees.

** The Physical Science Study Committee (PSSC) course material became available for general use in 1960. Since the late 1960's the percentage of graduate physics students who took PSSC in high school has increased and leveled off.

Table I examines seven characteristics of the total physics graduate student population and compares them with those of three of its subgroups—the first year graduate students and two groups of graduate degree recipients. In regard to changes from the previous year, both groups of graduate degree recipients show a higher percentage of women,—the terminal masters increased from 8% to 11% and the doctors from 6% to 7%. Foreign graduate physics students comprise higher percentages in 1977-78 than in the previous year. Although this change is in part due to a small increase in their numbers, it is largely due to the decreasing number of U.S. graduate students. Also, a higher proportion of degree recipients were part-time students during their last year of graduate work; this change is largely attributable to the acceptance of positions before the completion of the graduate degree.

As more data on minorities among the college and graduate student population become available, trends can be identified and analyses become more meaningful. **Table II** presents five characteristics reported by 1091 individual graduate physics students who identified themselves as members of a minority group, and only 3% did not specify the minority group. There is little change from last year in any of the characteristics for any group; however, the two largest groups, Orientals and Asian Indians both show decreases in the number of respondents. On the other hand Arabs show a 40% increase in one year. It should be noted that certain minority groups such as Asian Indians, Arabs and Other Latin Americans consist almost exclusively of foreign students. Among the 62 Oriental doctorate recipients only 9 are U.S. citizens. All three black PhD recipients are U.S. citizens.

Table II. Characteristics of minority-group graduate physics students, 1977-78.

		Black	American Indian	Puerto Rican	Mexican American	Other Latin American	Asian Indian	Oriental	Arab	Other
Characteristics	Total number	67	9	16	15	110	238	494	111	31
Sex	Female	8	1	4	-	19	32	68	12	1
	Male	59	8	12	15	91	206	426	99	30
Citizenship	U.S.	48	9	16	15	7	4	84	2	26
	Foreign	19	-	-	-	103	234	410	109	5
Full-time equivalent years of graduate study	< 1	14	2	4	3	22	29	88	15	3
	2	16	-	3	7	24	40	115	27	9
	3	12	-	1	1	20	40	71	25	7
	4	11	3	2	-	23	49	57	16	3
	5	7	2	3	4	8	34	68	13	6
	6	1	1	1	-	8	13	46	7	2
	> 7	6	1	2	-	5	33	49	8	1
Student status	Full-time	58	7	14	11	105	227	471	108	28
	Part-time	9	2	2	4	5	11	23	3	3
Subfields	Astrophysics	4	2	1	1	3	7	9	2	-
	Electron, atomic, molec.	5	1	4	1	6	11	24	12	3
	Elem. particles	3	1	3	2	14	33	60	7	3
	Nuclear	9	1	1	1	7	29	54	25	-
	Optics	5	1	-	1	6	11	25	13	3
	Solid state	22	1	6	5	46	98	199	33	11
	Cross-discipl. areas	2	-	-	1	4	5	17	2	6
	Other subfields	17	2	1	4	24	44	106	17	5
Graduate degree recipients	Terminal master's	7	-	1	1	-	9	20	4	2
	Doctorate	3	3	2	1	9	17	62*	8	3

* Only 9 out of the 62 doctors are U.S. citizens.

Table III estimates the total number of graduate students in nine major subfields and shows the distribution of students within each subfield for each level of graduate study in 1977-78. A major function of this table is to give an indication of the approximate number of graduates within each specialty who will be in the employment market shortly; the median

number of years of graduate study spent to get a physics doctorate is 5.4. A comparison of the distribution of subfields with that of the previous year shows small increases for mathematical physics, optics and solid state physics, and decreases for biophysics, elementary particles and nuclear physics.

Table III. Graduate physics students by subfield and years of graduate study completed, 1977-78

		Full-time equivalent years of graduate study									Total graduate students	
		< 1 yr.	2 yrs.	3 yrs.	4 yrs.	5 yrs.	6 yrs.	7 yrs.	8 yrs.	> 9 yrs.	N	%
Distribution* of students	N	2499	1967	1515	1298	1190	669	364	196	137	9835**	100%
	%	25.4	20.0	15.4	13.2	12.1	6.8	3.7	2.0	1.4		
Physics subfields:												
Astrophysics		182	102	81	83	48	35	26	9	2	568	5.8
Biophysics		97	90	53	44	42	23	21	12	4	386	3.9
Electron, atomic, molecular		135	142	121	132	102	85	35	16	11	779	7.9
Elem. particles		265	209	192	180	177	101	50	25	12	1211	12.3
Math. physics		202	116	59	57	55	27	14	11	7	548	5.6
Nuclear physics		232	187	129	123	140	76	30	14	12	943	9.6
Optics		132	114	75	64	51	28	17	4	5	490	5.0
Plasmas		120	90	105	85	88	33	14	18	7	560	5.7
Solid state physics		614	533	523	414	380	209	134	77	62	2946	30.0
Other subfields incl. general physics		520	384	177	116	107	52	23	10	15	1404	14.2

* The distribution of students in each subfield is based on the 5077 respondents to this question.

** This total was derived from the Survey of Enrollments and Degrees.

Table IV. Sources of support for graduate physics students by sex and degree status, 1977-78

Sources of support	Sex		Terminal master's	Candidates for: Master's enroute to PhD	PhD after master's	PhD only	Total	
	Female	Male					N	%
Teaching assistantship	42%	36%	46%	51%	28%	32%	1928	36%
Research assistantship	34	39	14	26	49	47	2089	39
Fellowship	9	10	4	8	9	14	536	10
Employment	8	8	24	7	8	3	429	8
Family, savings, loan	5	3	5	4	2	2	161	3
Other	2	3	6	4	3	2	160	3
Multiple sources of support, primarily with teaching assistantship	-	1	1	-	1	-	54	1
	100%	100%	100%	100%	100%	100%		
Total respondents	N 474	4883	696	857	2250	1554	5357	
	% 9%	91%	13%	16%	42%	29%		100%

The sources of support for graduate physics students are influenced by the level of graduate study as well as the candidacy for a degree. First and second year students hold most of the teaching assistantships while doctoral candidates

are more likely to be offered research assistantships. The highest percentage of fellowships is reported by students enrolled in doctoral programs that do not call for a master's degree enroute. Analyzing the sources of support with respect

Table V. Number* of advanced graduate physics students specializing in selected experimental or theoretical subfields by years of graduate study completed, 1977-78.

Physics subfields	Type of research	Full-time equivalent years of graduate study							Total
		3 yrs.	4 yrs.	5 yrs.	6 yrs.	7 yrs.	8 yrs.	> 9 yrs.	
Astrophysics	experimental	15	26	13	11	6	2	1	74
	theoretical	46	25	21	21	13	2	-	128
Biophysics	experimental	19	30	21	10	12	10	-	102
Electron, atomic, molecular	experimental	67	67	41	45	17	9	8	254
	theoretical	21	24	17	9	2	2	2	77
Elem. particles	experimental	70	101	83	40	29	15	8	346
	theoretical	74	57	63	40	27	6	6	248
Math. physics	theoretical	59	57	42	20	13	8	8	207
	experimental	69	67	94	36	13	4	8	291
Nuclear	theoretical	28	28	30	26	6	-	-	118
	experimental	39	30	24	12	6	-	-	111
Plasmas	experimental	30	36	44	11	4	10	6	141
	theoretical	34	19	28	11	5	5	-	102
Solid state	experimental	308	195	207	112	84	33	38	977
	theoretical	101	90	60	43	23	13	13	343
Other subfields	experimental	196	143	128	101	44	33	12	657
	theoretical	122	115	114	37	31	15	7	441
Total**	experimental	813	695	655	378	215	116	81	2953
	theoretical	485	415	375	207	95	51	36	1664

* The numbers in this table have been scaled up to reflect the total number of graduate students (5369) who completed three or more years of graduate study.

** In addition to the graduate students working on an experimental or theoretical thesis there are an estimated 752 graduate physics students who describe their studies as both experimental and theoretical.

Table VI. Type of research performed by doctoral candidates with respect to years of graduate study completed, 1977-78.

Type of research	Full-time equivalent years of graduate study			Total > 3 yrs.
	3 or 4 yrs.	5 or 6 yrs.	> 7 yrs.	
Experimental	53%	55%	59%	56%
Theoretical	32	31	26	31
Both	15	14	15	14
Total	100%	100%	100%	100%
Number of students	2813	1859	697	5369

to sex one finds a significant change from the previous year in the proportion of research assistantships offered to women. **Table IV** shows 34% of the women and 39% of the male graduate students with research assistantships which represent a six percentage-point increase for women and only a two percentage-point increase for men.

Since multiple sources of support are reported by a decreasing proportion of graduate students, individual sources of support appear to have become more adequate.

Most of the requests for information from the physics community concern physicists in a specific subfield and with a certain type of research. By the third year of graduate study it is possible to classify physics students with respect to theoretical or experimental subfields. Thus **Table V** presents an array of doctoral candidates who identified themselves with the major subfields and a level of graduate study; the information in this table also gives some indication of the time required to complete doctorates in the different subfields.

Combining all subfields **Table VI** focuses on the types of research and shows that a theoretical doctoral thesis generally appears to require less time than an experimental one.

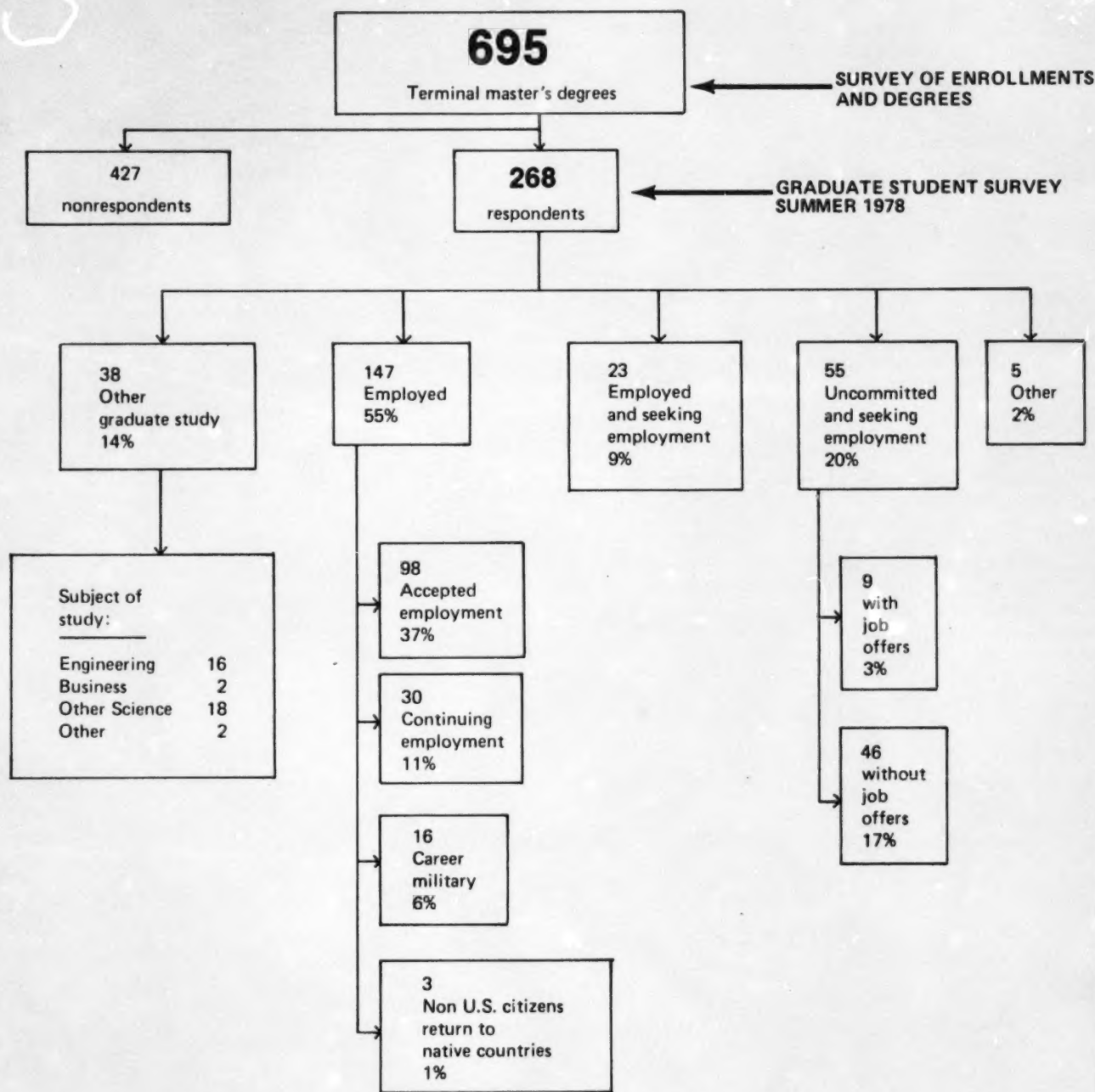
Disregarding the seven physicists classified as "Other" by **Figure IV** one is left with reports from 498 respondents all of whom are either committed to a position or are seeking a commitment. **Table VII** analyzes the employment opportunities of these 498 physicists with respect to the type of research and physics subfield of the dissertation. In particular, the table lists the major subfields and indicates whether the experimentalists or the theoreticians in a given subfield were in greater demand. For example 6% of the biophysicists reported "zero job offers" at the time of this survey; but all of the experimental biophysicists had at least one job offer. The bottom line of **Table VII**, showing all respondents, appears to indicate a greater demand for experimentalists than theoreticians.

Table VII. Employment offers for 1977-78 doctorate recipients by subfield and type of research.

Physics subfield	Total in subfield	Percentage of graduates within subfield received:			Type of research	Percentage of graduates within subfield received:			
		0 offer	1 offer	> 2 offers		0 offer	1 offer	> 2 offers	
Astrophysics	5.7%	8%	46%	46%	theor.	0	46	54	100%
Biophysics	4.0	6	33	61	exp.	0	44	56	100
Electron, atomic, molecular	8.6	3	49	48	exp.	0	42	58	100
Elem. particles	13.8	3	26	71	{ exp.	4	21	75	100
					{ theor.	5	30	65	100
Math. physics	3.1	9	55	36	theor.	10	50	40	100
Nuclear physics	10.1	9	54	37	{ exp.	9	48	43	100
					{ theor.	10	60	30	100
Optics	3.8	0	53	47		*	*	*	
Plasmas	5.9	4	42	54	theor.	10	60	30	100
Solid state	35.8	12	44	44	{ exp.	11	39	50	100
					{ theor.	16	40	44	100
Other subfields	9.2	-	-	-		-	-	-	
Total	100.0%	8%	45%	47%	{ exp.	6%	38%	56%	100%
					{ theor.	10	46	44	100

* Fewer than ten respondents.

Fig. III Post-degree plans of physics terminal master's degree recipients, 1977-78



Approximately 300 physics departments granted 695 terminal master's degrees between July 1977 and June 1978. Figure III presents the post-degree plans of 268 individual respondents from that group of graduates and shows increases over the previous year in employment and other graduate study while

the proportion of those who are uncommitted decreased by 3%. Tables VIII and IX offer details on the employment opportunities and the types of employers referred to in this flow diagram.

Table VIII. Post-degree plans of terminal masters by subfield, 1977-78.

Physics subfield	Total in subfield	Other graduate study	Other*	Employment offers received:			Total for each subfield
				0	1	≥2	
Acoustics	3.8%	1	1	0%	73%	27%	100%
Electron, atomic, molecular	9.3	-	1	21	43	36	100
Engineering & Appl. physics	7.1	1	-	18	24	58	100
Nuclear	8.3	2	-	15	65	20	100
Optics	9.4	3	-	17	35	48	100
Solid state	22.0	14	1	23	36	41	100
Cross-discipl. areas	12.7	3	-	20	50	30	100
General physics	16.2	8	-	15	57	28	100
All other subfields	12.2	7	5	23	57	20	100
Total	100.0%	15%	3%	17%	37%	28%	
No. of respondents	268	39	8	46	100	75	

* There were five graduates with no immediate plans and three who are foreign citizens and returned to their native countries.

A frequent question concerning employment opportunities is one which relates the graduate school subfield to the number of job offers. Table VIII addresses itself to that question and shows that graduates with an applied specialty received the highest proportion of multiple job offers. When comparing the 1978 terminal masters with the graduates of 1977 one finds a higher proportion of them in the cross-disciplinary areas and an overall increase in the proportion of masters with multiple offers.

Table IX focuses on the "employed" group presented in Figure III, regardless of whether a graduate continues to seek employment after accepting a position. Out of the 170 masters shown in Figure III, 160 reported both employer and work activity for inclusion in Table IX. The 16 masters who chose a military career listed the government as their employer. As expected, few of the masters are engaged in research and the majority (53%) are employed in industry.

Table IX. Type of employer and work activity of physics terminal masters, 1977-78.

Work activity	Sec. school	Coll.	Univ.	Industry	Gov't.	FFRC	Other	Total	
								N	%
Teaching	13	5	5	1	4	-	1	29	18
Research	-	-	9	5	2	1	-	17	11
Res. and dev.	-	-	2	36	8	3	2	51	32
Engineering	-	-	1	27	1	3	1	33	21
Computer science	-	-	1	8	1	-	-	10	6
Other	-	-	-	7	10	1	2	20	12
N	13	5	18	84	26	8	6	160	
Total	%	8	3	11	53	16	5	4	100%

Fig. IV. Background characteristics and post-doctorate status of 1977-78 physics graduates

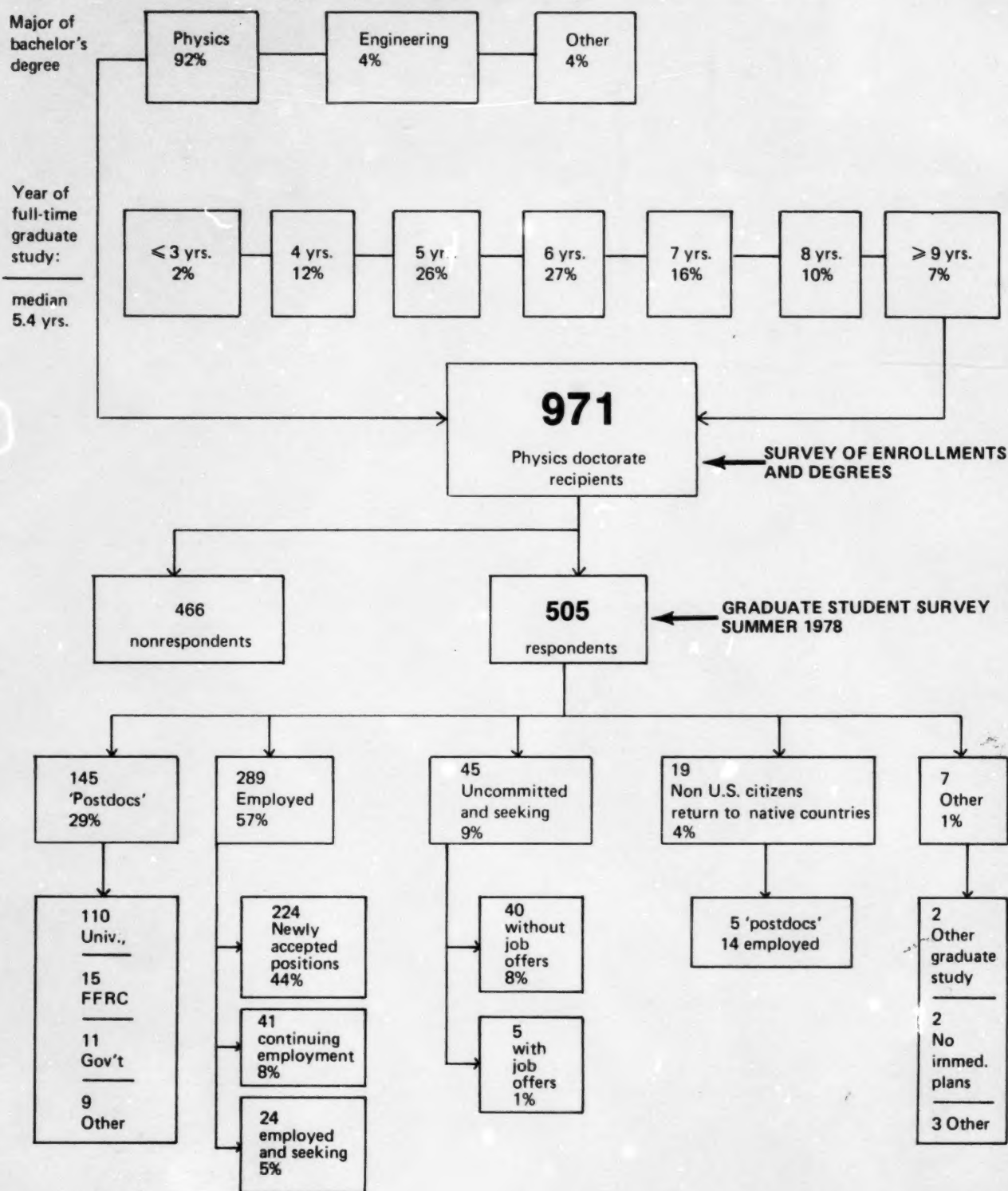


Figure IV presents the background characteristics and post-doctorate status of 1977-78 physics graduates. The background characteristics show an increase in the percentage of graduates from 12% to 17% who took eight years or longer

to complete the PhD; the median number of years of graduate study required to complete a physics doctorate increased only from 5.3 years to 5.4 years.

Table X. Use of physics in potentially permanent employment of graduate degree recipients, 1977-78.

Type of employer		Use of physics training			Total	
		Extensive	Little	None	N	%
Doctorate recipients	Univ.-tenurable	18	1	-	19	7
	Univ.-nontenurable	55	4	-	59	22
	4-yr. coll.	13	2	2	17	6
	2-yr. coll.	9	3	-	12	4
	Industry	77	25	3	105	39
	FFRC/Gov't.	47	4	-	51	19
	Other	3	4	-	7	3
Total doctorate recipients	N %	222	43	5	270	
		82	16	2		100%
Terminal masters	Univ./coll	17	6	-	23	15
	Industry	44	34	5	83	56
	FFRC/Gov't.	22	12	1	35	24
	Other	2	5	-	7	5
	Total terminal masters	N %	85	57	6	148
57			39	4		100%

The post-doctorate status was reported by 505 individual PhD recipients during the summer of 1978, and only those physicists are included in this flow diagram who received the physics doctorate between July 1977 and June 1978. When comparing the components of Figure IV with those that described the previous year's graduates one finds a five percentage-point drop in 'postdocs' from 34 to 29, and an eleven percentage-point increase in the "employed" group. While the total number of uncommitted degree recipients is considerably smaller than last year, the proportion without job offers remained at 8%, and the group that reported having received offers but not accepted any of them yet declined from 6% to 1%.

Having related the subfields to the employment offers in Table VII, the report of how extensively a physics education is utilized by a graduate's initial employment, is presented in Table X. This table includes both terminal masters and doctorate recipients, but only those of the latter group who described their positions as potentially permanent. 'Postdocs' are excluded from this table because the primary reason for accepting this type of temporary position, is the extensive use it makes of the graduate's training. Thus Table X lists major types of employers for each group of degree recipients and shows that a higher proportion of doctoral-level physicists than masters make extensive use of their training.

Starting salaries are shown in Table XI and do not include salaries reported by graduates who are continuing their employment. For example, the monthly starting salary for terminal masters shown in Table XI is \$1450.—while those who are continuing their employment reported \$1520./month. Only ten women graduates are among the masters who reported salaries, and their median monthly starting salary was \$1370.—while that paid to the men was \$1470.— Since postdoctoral fellowships command a lower salary than positions with potential permanence, Table XI presents these two types of salaries in separate columns. The overall increase in postdoctoral salaries is less than 3% because only government and FFRC 'postdocs' show higher salaries over the previous year—salaries paid to 'postdocs' by universities remained constant.

For the first time the 1978 questionnaire distinguished between tenurable and non-tenurable positions at universities that offer potentially permanent employment. As shown in Table XI, 27% of the doctoral respondents accepted such positions but only one out of four positions were described as "tenurable". Industrial positions continue to pay the highest salaries with \$1910.—representing a 12% increase over the previous year.

Table XI. Median monthly salaries paid by U.S. employers to new physics graduates, 1977-78.**

Type of employer	Terminal master's recipients		Doctorate recipients			
	Percentage accepting positions	Monthly starting salaries	Percentage accepting: 'Postdocs'	Potentially permanent pos.	Monthly starting salaries for: 'Postdocs'	Potentially permanent pos.
Secondary school	8%	*	-	-	-	-
4-year college	3	*	-	3%	-	\$1250
University	11	\$1075	25%	27	\$1060	1160
Industry	53	1490	-	19	-	1910
Government	16	1500	3	6	1450	1650
FFRC	5	*	3	8	1270	1725
Other	4	*	2	4	*	*
All employers	100%	\$1450	100%		\$1130	\$1620

* Fewer than ten graduates reported salaries.

** Salaries shown in this table are based on newly accepted positions.

Table XII. Type of employment and citizenship of physics doctorate recipients, 1977-78.

Type of employment	in the U.S. 420		outside the U.S. 33		Total 453
	Citizenship U.S.	Foreign	Citizenship U.S.	Foreign	
'Postdoc'	110	25	10	5	150
Potentially permanent	243	42	4	14	303
Total	353	67	14	19	453
	78%	15%	3%	4%	100%

Throughout the 1960's foreign students who completed physics doctorates at U.S. universities and wanted to remain here, appeared to have no difficulty finding positions. The recession of the early 1970's changed all that, but by 1978 an increasing proportion of foreign graduates remains in the U.S. to start employment. **Table XII** presents the responses of 453

doctorate recipients to the question of employment in a foreign country. American citizens seeking employment outside the U.S. remained at 3% while the percentage of foreign graduates who remain in the U.S. for initial employment increased from 13% to 15% in one year.

ASTRONOMY

Four years ago the seventeen-year old Graduate Physics Student Survey was expanded to include graduate astronomy students; thus the summer of 1978 was the fourth successive year in which individual astronomy students contributed information to this annual survey. There are 34 separate graduate astronomy departments in addition to 16 that are

combined with graduate physics departments. Reports from the chairmen of these 50 astronomy departments indicate a decline from 803 to 710 graduate astronomy students, 67% of whom form the basis of the analysis presented in this part of the report.

Table XIII. Characteristics of astronomy graduate students and doctorate recipients, 1977-78.

Characteristics		All graduate students	First-year graduate students	Doctorate recipients
Total Population*: Number of respondents:		710 478	145 88	93 61
Sex	Female	13%	20%	7%
	Male	87	80	93
Citizenship	U.S.	90%	90%	89%
	Foreign	10	10	11
Type of high school physics	PSSC**	33%	26%	40%
	Project physics	5	11	1
	Other	53	46	53
	None	9	17	6
Type of bachelor's institution	PhD-granting	63%	51%	72%
	MS-granting	7	13	4
	BS/BA-granting	20	28	10
	Foreign	10	8	14
Type of graduate institution	PhD-granting	97%	91%	100%
	MS-granting	3	9	-
Student status	Full-time	92%	92%	79%
	Part-time	8	8	21
Source of support	Teaching assistantship	26%	42%	12%
	Research assistantship	40	15	47
	Fellowship	19	26	12
	Employment	9	6	17
	Family, savings, loan	3	5	7
	Other	3	6	5

* These totals were reported by astronomy department chairmen as part of the Survey of Enrollments and Degrees.

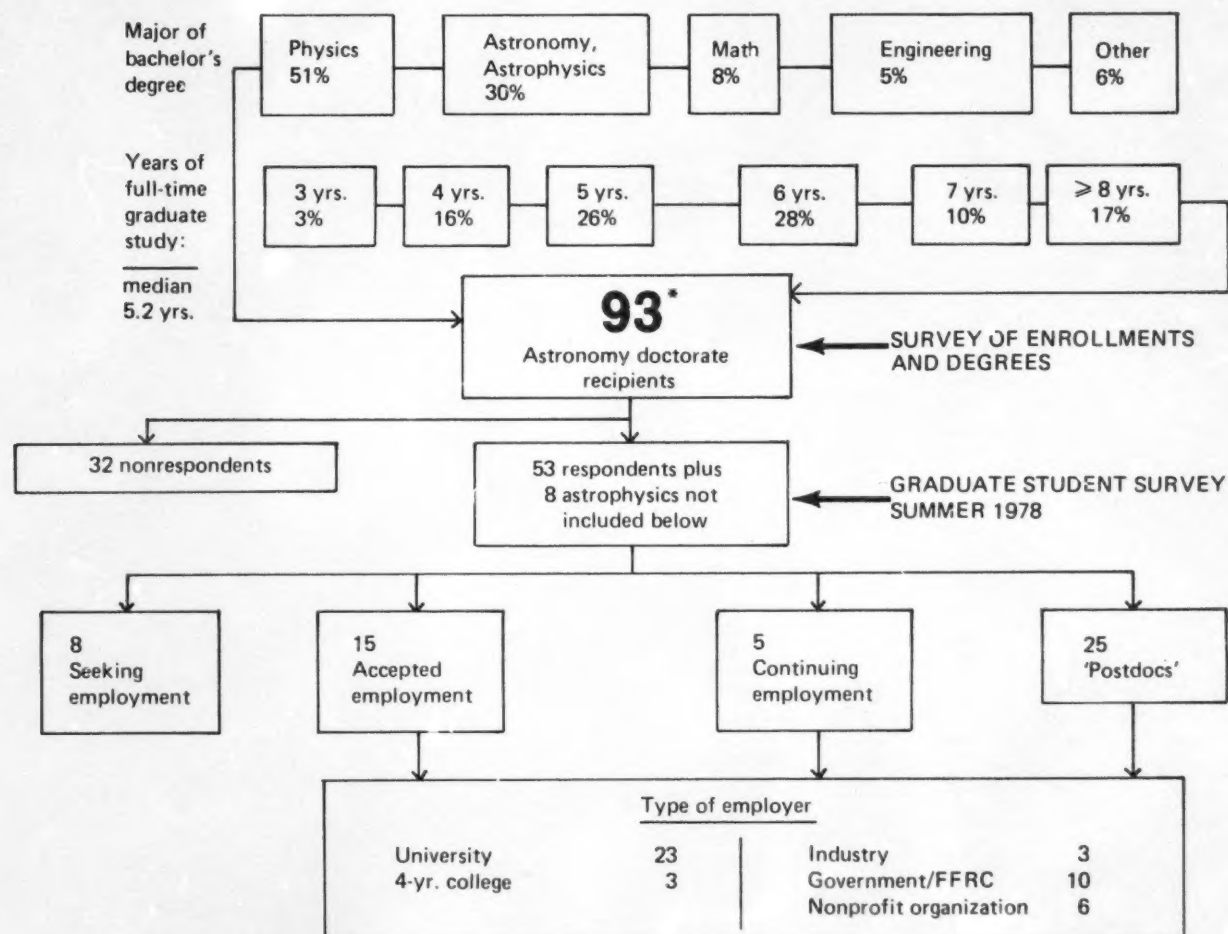
** The Physical Science Study Committee (PSSC) course material became available for general use in 1960. Since the late 1960's the percentage of graduate physics students who took PSSC in high school has increased and leveled off.

Table XIV. Graduate astronomy students by subfield and years of graduate study completed, 1977-78.

		Full-time equivalent years of graduate study						Total graduate students	
		< 1 yr.	2 yrs.	3 yrs.	4 yrs.	5 yrs.	> 6 yrs.	N	%
Distribution of students:	N	142	135	128	114	92	99	710*	
	%	20	19	18	16	13	14		100
<u>Astronomy subfields</u>									
Astronomical instruments and techniques		11%	4%	7%	10%	3%	14%	57	8%
Cosmology, extragalactic objects, quasi-stellar objects		22	26	22	18	11	14	142	20
Galactic structure, stellar motions		5	4	9	7	11	4	50	7
Interstellar matter and gaseous nebulae		4	12	18	18	16	17	99	14
Solar system, space astronomy of the solar system		14	10	7	11	3	6	51	9
Stellar atmospheres and spectra, stellar evolution, solar and stellar interiors		13	17	17	22	37	30	149	21
Supernovae, X, γ and cosmic rays, pulsars		5	1	6	6	5	1	28	4
The sun		6	1	-	2	3	4	21	3
Astrophysics		12	11	8	4	8	8	64	9
All other subfields combined		8	14	6	2	3	2	36	5
		100%	100%	100%	100%	100%	100%		100%

* The percentages shown in this table are based on 478 respondents to the Graduate Student Survey. Astronomy department chairmen reported a total of 710 graduate students for the Survey of Enrollments and Degrees.

Fig. V Background characteristics and post-doctorate status of 1977-78 astronomy doctorate recipients



* This total includes an estimated 12 astrophysics doctorates granted by astronomy departments.

Fig. VI Postdoctorate status of astrophysics graduates, 1977-78

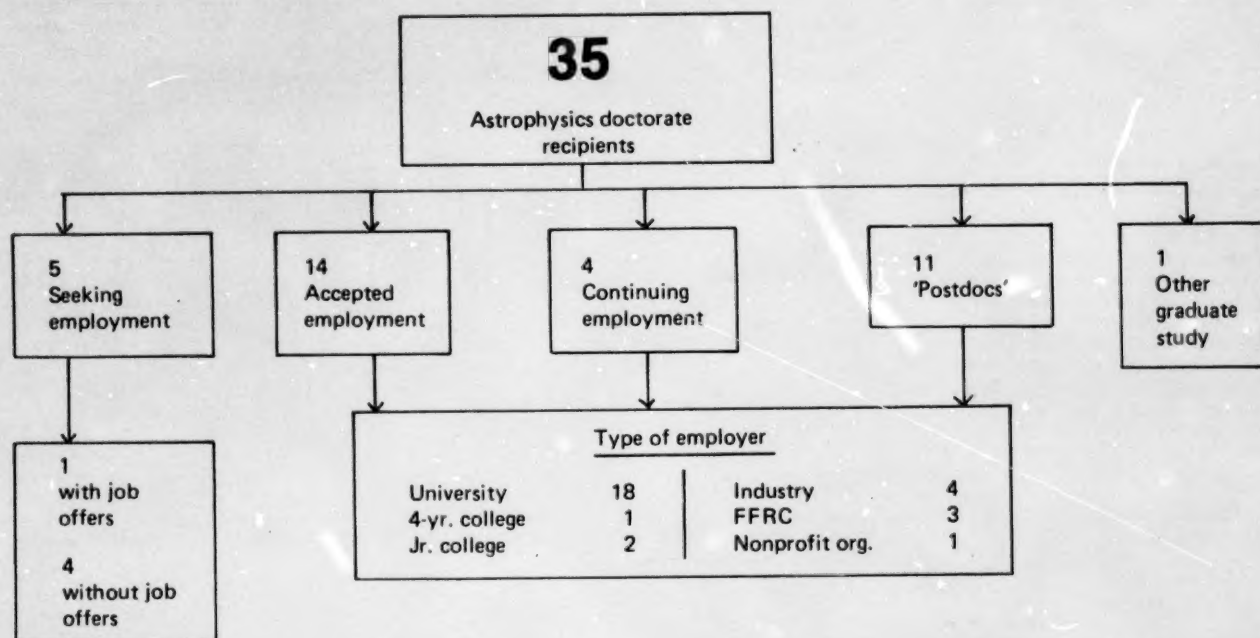


Table XIII lists seven characteristics of all graduate astronomy students as well as for two subgroups:—the first-year graduate students and the doctorate recipients. According to the Survey of Enrollments and Degrees 31 astronomers graduated with a terminal master's degree in 1977-78, but only eleven masters completed questionnaires for this survey which seemed like too small a group to analyze separately in Table XIII. The seven characteristics show little or no change from the year before. Compared with physics students, astronomers include smaller proportions of foreign students as well as minorities, but a larger proportion of women.

Table XIV presents the distribution of graduate students by level of graduate study and lists nine major subfields including astrophysics. Only 38% of the astronomy students describe their research as observational compared with 52% of the physics students who are experimentalists.

Figure V focuses on the graduates from 43 doctorate-granting astronomy departments, 14 of which are combined departments with physics. The background of these graduates is a physics bachelor's degree for the majority of astronomers, because there are fewer than twenty astronomy programs in the U.S. offering an undergraduate astronomy degree.

While the median number of years of graduate study for an astronomy doctorate remained constant, the percentage of students who required seven or more years increased from 18% to 27%.

In a comparison with physics doctorate recipients the astronomers experienced a similar pattern of employment offers; 7% of the 59 respondents reported no job offers shortly after graduation; 48% had one offer and 45% had multiple offers to choose from.

The lower portion of Figure V analyzes the employment plans of only 53 of the 61 respondents so as to group the astrophysicists together in Figure VI irrespective of the degree-granting department; thus the proportion of astronomers who accept 'postdocs' is higher than that for physicists or astrophysicists. As expected, very few astronomers accepted industrial positions, and only eight graduates were still uncommitted after completing their doctorates.

Since astrophysics is a large astronomy subfield and its degrees are granted by astronomy as well as physics departments, it seemed logical to present a flow diagram based on both groups of astrophysics doctorate recipients, 1977-78; there were eight from astronomy departments and 27 from physics departments. Although the numbers in Figures V and VI are small, a comparison of the two groups of graduates points to a higher proportion of offers with potential permanence for the astrophysicists, while more astronomers are offered 'postdocs'.